

Computational Lexical Semantics

Verbsemantik – Levin (1993)

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- 1 Worum geht's?
- 2 Seminarüberblick
- 3 Wiederholung
- 4 Levin (1993)

Aus der Kursbeschreibung:

Das Lexikon enthält diejenigen semantischen Informationen, die für die Bedeutungskomposition notwendig sind.

- 1 Welche Einheiten enthält das Lexikon?
⇒ Morpheme, **Worte** (Wortformen, Lexeme), Phrasen, ...
- 2 Was ist “die Bedeutung”?
⇒ Problem: Mehrdeutigkeit, Abstraktheit
- 3 Wie repräsentieren wir (lexikalische) Bedeutung?
⇒ Paraphrasen, logische Formeln, Merkmalsstrukturen, Typenhierarchien, Vektoren, ...

In diesem Seminar

eine **Auswahl** (2 SWS!) computerlinguistischer “Antworten”

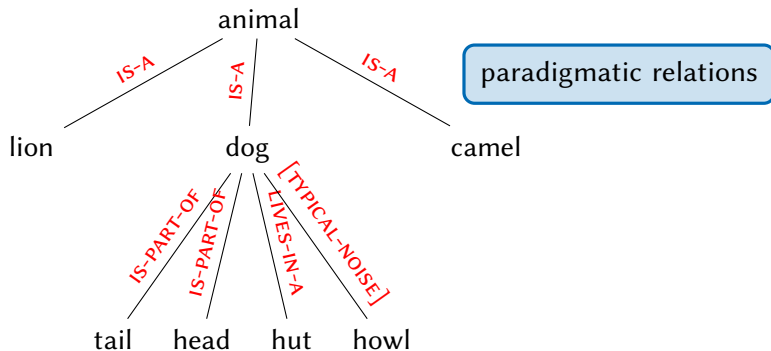
- 1 Theorie: Lexikon & lexikalische Semantik
- 2 Lexikalische Ressourcen: WordNet, FrameNet, VerbNet
- 3 Semantisch annotierte Korpora: SemCor, PropBank, OntoNotes
- 4 Anwendungen:
 - Word Sense Disambiguation
 - Semantic Role Labeling
 - ...

2. Was ist “die Bedeutung”?

- 1 Contextual/holistic approach (sense relations)
- 2 Componential/localist approach (semantic decomposition)
- 3 Conceptual approach

2. Was ist “die Bedeutung”?

1 Contextual/holistic approach (sense relations)

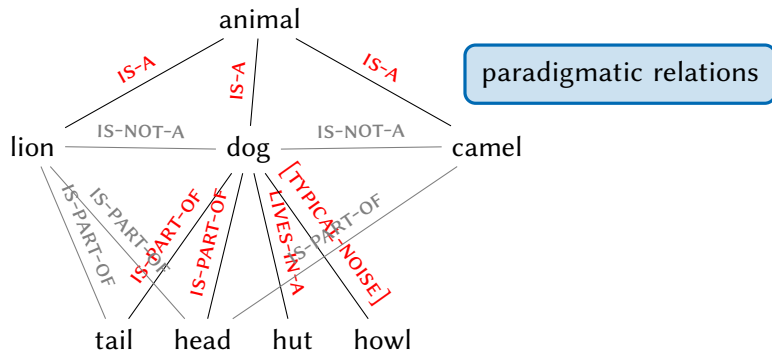


2 Componential/localist approach (semantic decomposition)

3 Conceptual approach

2. Was ist “die Bedeutung”?

1 Contextual/holistic approach (sense relations)



2 Componential/localist approach (semantic decomposition)

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2. Was ist “die Bedeutung”?

1 Contextual/holistic approach (sense relations)

- (1) The Prime Minister attended the White House reception accompanied by his *Dad/father*.
- (2) John drank the *wine / filing cabinet*.
- (3) a *male/female* aunt

syntagmatic relations

2 Componential/localist approach (semantic decomposition)

3 Conceptual approach

2. Was ist “die Bedeutung”?

- 1 Contextual/holistic approach (sense relations)
- 2 Componential/localist approach (semantic decomposition)

| | | |
|-------|---|--|
| filly | = | [HORSE] [FEMALE] [YOUNG] |
| boy | = | [HUMAN] [MALE] [YOUNG] |
| kill | = | [CAUSE] [BECOME] [NOT] [ALIVE] |
| chair | = | [OBJECT] [FURNITURE] [FOR SITTING] [FOR ONE PERSON] [WITH BACK] |

- 3 Conceptual approach

2. Was ist “die Bedeutung”?

- 1 Contextual/holistic approach (sense relations)
- 2 Componential/localist approach (semantic decomposition)
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???

Four strategies to lexical specification of the “interface”:

- 1 **Atomic predication:** No interface language is provided, and there is direct interpretation of an object expression into the model.
- 2 **Relational models:** The interface is a relational structure, which is interpreted in the model.
- 3 **Feature-based decomposition:** Component-based features are used to classify an expression in the object language into distinct concepts in the model.
- 4 **Structural decomposition:** Component-based features are organized as a graph structure, with associated compositional interpretations in the model.

kill: (CAUSE(x,(BECOME(NOT(ALIVE y))))))¹

¹Following Dowty (1979).

Further aspects of verbal meaning:

- argument structure & selectional constraints

(1) laugh(arg 1 [cat=NP,animacy=+])

- a. *The man laughed the ball.
- b. The man / *the rock laughed.

- semantic roles

(2) a. put⟨agent,theme,location⟩

b. borrow⟨recipient,theme,source⟩

- alternations

(3) a. The glass **broke**.

b. Mary **broke** the glass.

- event types / Aktionsarten (Vendler 1957) :
state, activity, accomplishment, achievement

Levin, Beth. 1993. English Verb Classes and Alternations: A Preliminary Investigation. Chicago, IL: University of Chicago Press.

Leitfragen:

- Was ist die Grundhypothese?
- Welche Gruppen von Verben werden aufgrund ihrer Alternationsmöglichkeiten unterschieden?
- Welche semantischen Eigenschaften werden den Alternationsmöglichkeiten zugeordnet?

*This work is guided by the assumption that **the behavior of a verb, particularly with respect to the expression and interpretation of its arguments, is to a large extent determined by its meaning.** Thus verb behavior can be used effectively to probe for linguistically relevant pertinent aspects of verb meaning. This book offers an attempt at delimiting and systematizing the facets of verb behavior. Its contents should help pave the way toward the development of a theory of lexical knowledge. Ideally, such a theory must provide **linguistically motivated lexical entries** for verbs which incorporate a representation of verb meaning and which allow the meanings of verbs to be properly associated with the syntactic expressions of their arguments.*

Levin (1993): The nature of lexical knowledge

The lexicon is really an appendix of the grammar, a list of basic irregularities. – Bloomfield (1935)

⇒ BUT: “incomplete picture of lexical knowledge”; “There is more to lexical knowledge than knowledge of idiosyncratic word-specific properties.”

[T]he speaker’s ability to make subtle judgments about possible and actual verbs and their properties makes it unlikely that all that a speaker knows about a verb is indicated in its lexical entry.

⇒ How does Levin arrive at this conclusion?

Diathesis alternations

alternation in the expression of arguments, sometimes accompanied by changes of meaning

Locative alternation:

- (4) a. The farmer **loaded** apples into the cart.
- b. The farmer **loaded** the cart with apples.
- (5) a. The farmer **dumped** apples into the cart.
- b. *The farmer **dumped** the cart with apples.
- (6) a. *Gina **filled** lemonade into the pitcher.
- b. Gina **filled** the pitcher with lemonade.

Transitivity alternation / causative-inchoative alternation:

- (7) a. The window **broke**. (inchoative variant)
- b. The little boy **broke** the window. (causative variant)
- (8) a. A rabbit **appeared** out of the magician's hat.
- b. *The magician **appeared** a rabbit out of his hat.

Levin (1993): The nature of lexical knowledge

The point is: The knowledge of appropriate alternations is readily available also for **new verbs!**

- (9) “I’ll **modem** him tomorrow,” said one of them, urged by Mr. Krens to get in touch with an out-of-town colleague. (Arts and Leisure Section, New York Times, May 29, 1988, p. 1)
- (10)*They **churched** the money.
- (11) a. The bullet **whistled** through the window.
b. The car **roared** up the driveway.
c. *The dog **barked** down the street behind the jogger.

Levin (1993): Verb meaning: A key to verb behaviour

Another example: **gally** ('see' or 'frighten') and the middle transitivity alternation

- (12) a. The sailors **gallied** the whales.
b. *The whales **gally** / **see** easily.
c. The whales **gally** / **frighten** easily.

⇒ The middle construction is only possible with verbs whose meaning involves a notion of **causing a change of state**.

So again:

[T]he speaker's ability to make subtle judgments about possible and actual verbs and their properties makes it unlikely that all that a speaker knows about a verb is indicated in its lexical entry.

Levin (1993): A more complex example

break, cut, hit, touch

- all transitive

- (13) a. Margaret *cut* the bread.
b. Janet *broke* the vase.
c. Terry *touched* the cat.
d. Carla *hit* the door.

- middle alternation

- conative alternation

- body-part possessor ascension alternation

- causative/inchoative alternation

Levin (1993): A more complex example

break, cut, hit, touch

- all transitive
- middle alternation
 - (13) a. The bread *cuts* easily.
 - b. Crystal vases *break* easily.
 - c. *Cats *touch* easily.
 - d. *Door frames *hit* easily.
- conative alternation
- body-part possessor ascension alternation
- causative/inchoative alternation

Levin (1993): A more complex example

break, cut, hit, touch

- all transitive
- middle alternation
- conative alternation
 - (13) a. Margaret *cut* at the bread.
 - b. *Janet *broke* at the vase.
 - c. *Terry *touched* at the cat.
 - d. Carla *hit* at the door.
- body-part possessor ascension alternation
- causative/inchoative alternation

Levin (1993): A more complex example

break, cut, hit, touch

- all transitive
- middle alternation
- conative alternation
- body-part possessor ascension alternation
 - (13) a. Margaret *cut* Bill's arm.
b. Margaret *cut* Bill on the arm.
 - (14) a. Janet *broke* Bill's finger.
b. *Janet *broke* Bill on the finger.
 - (15) a. Terry *touched* Bill's shoulder.
b. Terry *touched* Bill on the shoulder.
 - (16) a. Carla *hit* Bill's back.
b. Carla *hit* Bill on the back.
- causative/inchoative alternation

Levin (1993): A more complex example

break, cut, hit, touch

- all transitive
- middle alternation
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- body-part possessor ascension alternation
- causative/inchoative alternation

(13) a. The window *broke*.

b. The little boy *broke* the window.

(14) a. Margaret *cut* the string.

b. *The string *cut*. (on the interpretation "became cut")

(15) a. Terry *touched* the cat.

b. *The cat *touched*.

(16) a. Carla *hit* the door.

b. *The door *hit*.

Levin (1993): A more complex example

| | touch | hit | cut | break |
|------------------------------------|-------|-----|-----|-------|
| Middle | - | - | + | + |
| Conative | - | + | + | - |
| Body-Part Possessor Ascension | + | + | + | - |
| (Causative/Inchoative Alternation) | - | - | - | + |

- (17) a. Break Verbs: break, crack, rip, shatter, snap, . . .
b. Cut Verbs: cut, hack, saw, scratch, slash, . . .
c. Touch Verbs: pat, stroke, tickle, touch, . . .
d. Hit Verbs: bash, hit, kick, pound, tap, whack, . . .

⇒ relevant meaning components?

Relevant meaning components:

- middle alternation

- (18) a. The bread *cuts* easily.
b. Crystal vases *break* easily.
c. *Cats *touch* easily.
d. *Door frames *hit* easily.

- conative alternation

- body-part possessor ascension alternation

- causative/inchoative alternation

Relevant meaning components:

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- (18) a. The bread *cuts* easily.
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causing a
change of state

- conative alternation

- body-part possessor ascension alternation

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Relevant meaning components:

- middle alternation
- conative alternation
 - (18) a. Margaret *cut* at the bread.
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- body-part possessor ascension alternation
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Relevant meaning components:

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- (18) a. Margaret **cut** at the bread.
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c. *Terry **touched** at the cat.
d. Carla **hit** at the door.

contact & motion

- body-part possessor ascension alternation
- causative/inchoative alternation

Relevant meaning components:

- middle alternation
- conative alternation
- body-part possessor ascension alternation
 - (18) a. Margaret **cut** Bill's arm.
 - b. Margaret **cut** Bill on the arm.
 - (19) a. Janet **broke** Bill's finger.
 - b. *Janet **broke** Bill on the finger.
 - (20) a. Terry **touched** Bill's shoulder.
 - b. Terry **touched** Bill on the shoulder.
 - (21) a. Carla **hit** Bill's back.
 - b. Carla **hit** Bill on the back.
- causative/inchoative alternation

Relevant meaning components:

- middle alternation
- conative alternation
- body-part possessor ascension alternation

(18) a. Margaret **cut** Bill's arm.

b. Margaret **cut** Bill on the arm.

(19) a. Janet **broke** Bill's finger.

b. *Janet **broke** Bill on the finger.

contact

(20) a. Terry **touched** Bill's shoulder.

b. Terry **touched** Bill on the shoulder.

(21) a. Carla **hit** Bill's back.

b. Carla **hit** Bill on the back.

- causative/inchoative alternation

Relevant meaning components:

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(18) a. The window *broke*.

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(20) a. Terry *touched* the cat.

b. *The cat *touched*.

(21) a. Carla *hit* the door.

b. *The door *hit*.

Relevant meaning components:

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b. *The door *hit*.

pure change of state

Levin (1993): A more complex example

Relevant meaning components:

- middle alternation
- conative alternation
- body-part possessor ascension alternation
- causative/inchoative alternation

touch: contact

hit: contact by motion

cut: causing a change of state by moving something into contact with the entity that changes state

break: pure change of state.

Levin (1993): A more complex example

| | contact | motion | change of state |
|------------------------------------|---------|--------|-----------------|
| Middle | | | + |
| Conative | + | + | |
| Body-Part Possessor Ascension | + | | |
| (Causative/Inchoative Alternation) | - | - | + |

*The picture that emerges is that a verb's behavior arises from the **interaction of its meaning and general principles of grammar**. Thus the lexical knowledge of a speaker of a language must include knowledge of the meaning of individual verbs, the meaning components that determine the syntactic behavior of verbs, and the general principles that determine behavior from verb meaning.*

Levin (1993): The larger context

The lexicon is really an appendix of the grammar, a list of basic irregularities. – Bloomfield (1935)

These observations [alternation patterns of verbs] about the nature of lexical knowledge fit well with proposals that the ideal lexical entry for a word should minimize the information provided for that word.

And since a word's meaning is necessarily idiosyncratic, the inclusion of a word's meaning in its lexical entry conforms to Bloomfield's characterization of the lexicon as a locus of idiosyncrasy.

Lexical entries may contain even less information than has sometimes been proposed.

⇒ Subcategorization frames might be predictable from the meaning.

- The hypothesis that the syntactic behavior of a word is fully semantically determined is **not uncontroversial**.
- The key to maintaining this hypothesis is the identification of the appropriate representation of verb meaning.

Purported counterevidence: **Unaccusative Hypothesis**

- Is an intransitive verb unaccusative or unergative?
- semantics does not predict this correctly (Rosen 1984)
 - bodily process verbs in Italian: *russare* ‘snore’ vs. *arrossire* ‘blush’
- BUT: “bodily process” is not relevant to verb classification!
- RATHER: *snore* is an activity, *blush* is a change of state
- and this has been shown to be relevant to the Unaccusative Hypothesis

Levin (1993): The underlying research methodology

observation/behaviour

semantics

- ⇒ unexpected similarities and differences between verbs
- ⇒ TODO: more structured lexical representations

Levin (1993): The underlying research methodology

observation/behaviour

alternation *A* is compatible with specific verbs

verb *V* is compatible with specific alternations

semantics

- ⇒ unexpected similarities and differences between verbs
- ⇒ TODO: more structured lexical representations

Levin (1993): The underlying research methodology

observation/behaviour

alternation A is compatible with specific verbs

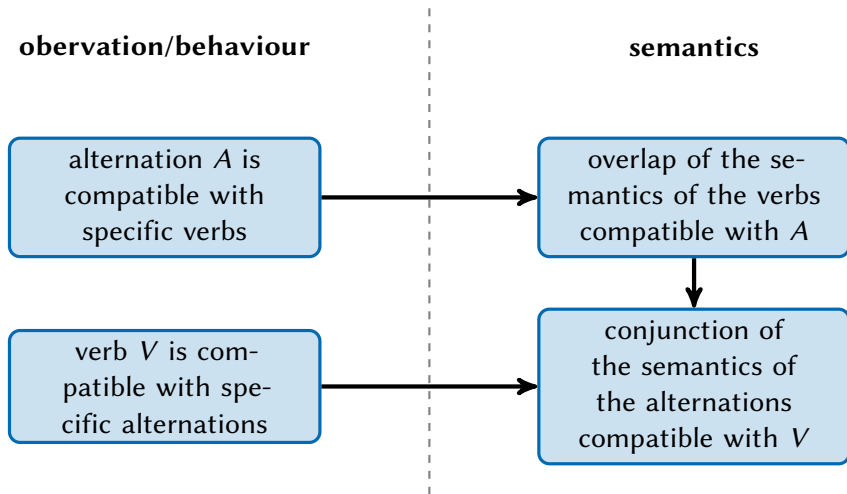
verb V is compatible with specific alternations

semantics

overlap of the semantics of the verbs compatible with A

- ⇒ unexpected similarities and differences between verbs
- ⇒ TODO: more structured lexical representations

Levin (1993): The underlying research methodology



⇒ unexpected similarities and differences between verbs

⇒ TODO: more structured lexical representations

<https://verbs.colorado.edu/~mpalmer/projects/verbnet.html>

Class Hit-18.1 (simplified)

- Roles and Restrictions: Agent[+int_control] Patient[+concrete] Instrument[+concrete]
- Members: bang, bash, hit, kick, ...
- Frames:
 - Name: Basic Transitive
 - Example: Paula hit the ball
 - Syntax: Agent V Patient
 - Semantics: cause(Agent, E) manner(during(E), directedmotion, Agent) !contact(during(E), Agent, Patient) manner(end(E),forceful, Agent) contact(end(E), Agent, Patient)

verb meaning \Leftrightarrow verb behaviour (= available alternations)

- A method to extract semantic properties from syntax data.
- feature-based decomposition

- [1] Bloomfield, Leonard. 1935. *Language*. London: George Allen & Unwin.
- [2] Cruse, D. Alan. 2001. The lexicon. In, 238–264.
- [3] Dowty, David R. 1979. *Word meaning and Montague Grammar*. Reprinted 1991 by Kluwer Academic Publishers. Dordrecht, Boston, London: D. Reidel Publishing Company.
- [4] Levin, Beth. 1993. *English verb classes and alternations: A preliminary investigation*. Chicago, IL: University of Chicago Press.
- [5] Pustejovsky, James. 2016. Lexical semantics. In Maria Aloni & Paul Dekker (eds.), *The cambridge handbook of formal semantics* (Cambridge Handbooks in Language and Linguistics), chap. 2, 33–64. Cambridge, UK: Cambridge University Press.
- [6] Vendler, Zeno. 1957. Verbs and times. *The Philosophical Review* 66(2). 143–160.